DUBLIN

QUARRY FEVER CASES

A STUDY OF 1153 CASES OF SCARLET FEVER

WITH ESPECIAL REFERENCE TO THEIR SEQUELAE

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A Study of 1,153 Cases of Scarlet Fever

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It is the primary purpose of this paper to report on an investigation into the sequelae of scarlet fever. It has been possible, in addition, to examine some general characteristics of the cases under review, and these, too, will be considered in the report. The plan which has been followed was developed in a study of the sequelae of typhoid fever,[1] namely, to trace the condition of the survivors of the disease as far as is possible through an interval of four or five years subsequent to recovery, and to note especially the occurrence of any undue number of deaths during this period from causes which may be considered sequelae of the primary disease. In the case of typhoid fever, I was able to show that, in a series of 1,428 cases in which the patients had survived the attack of that disease, the mortality during the three following years was twice as great as was to be expected from the age, sex, and color of the group. This high rate of mortality resulted from an increase in the number of deaths from tuberculosis and organic heart disease. In view of the well known effect exerted by scarlet fever on the heart and kidney tissues, it seemed likely that an analogous condition of high subsequent mortality might be found to prevail. In any case, it was desired to measure exactly the conditions which actually arise.

The records of the Visiting Nurse Service of the Metropolitan Life Insurance Company again gave us

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1. Dublin, L. I.: Typhoid Fever and Its Sequelae, Am. Jour. Pub. Health, 1915, v, No. 1.

the original material for the investigation. There were 1,153 cases of scarlet fever in the two years 1911 and 1912 among white persons. The patients were all treated by physicians. The accuracy of the diagnosis was in little or no doubt, and the records in other respects were fairly complete and trustworthy. The patients were all policyholders of the company, and their whereabouts and physical condition could readily be traced during the subsequent years. For those patients who died, full and comprehensive medical records were at hand for examination.

Table 1 shows the distribution of the 1,153 primary cases by sex and by age period.

TABLE 1.—DISTRIBUTION OF 1,153 CASES OF SCARLET FEVER BY SEX AND AGE

Age	Males and Females		Males		Females	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
All Ages.........	1,153	100.0	501	100.0	652	100.0
2 to 10..........	941	81.6	433	86.4	508	77.9
2 to 5..........	503	43.6	254	50.7	249	38.2
2...............	103	8.9	63	12.6	40	6.1
3...............	132	11.4	57	11.4	75	11.5
4...............	148	12.8	73	14.6	75	11.5
5...............	120	10.4	61	12.2	59	9.0
6 to 10..........	438	38.0	179	35.7	259	39.7
6...............	123	10.7	54	10.8	69	10.6
7...............	114	9.9	47	9.4	67	10.3
8...............	76	6.6	31	6.2	45	6.9
9...............	65	5.6	22	4.4	43	6.6
10...............	60	5.2	25	5.0	35	5.4
11 to 15..........	132	11.4	53	10.6	79	12.1
16 to 20..........	43	3.7	11	2.2	32	4.9
21 to 30..........	24	2.1	4	0.8	20	3.1
31 to 40..........	13	1.1	..	....	13	2.0

Nearly 82 per cent. of all the cases were among children between 2 and 10; the company has no policyholders in the first year of life. The greatest disposition to the disease is found among children from 3 to 7 years of age; 637 cases, or.55.2 per cent. of the total, were found within these five years of life. The period 11 to 15 presents an appreciable number of cases; but after this period the cases are few and far between, all of them amounting to only 6.9 per cent. of the total. We are, therefore, concerned primarily with children. In this respect our series agrees substantially with other scarlet fever series. McCollom, for example, reports that 75 per cent. of his patients treated at the Boston City Hospital were between the

ages of 2 and 10, and 50 per cent. between the ages of 3 and 7. The figures for Willard Parker Hospital cases are very similar. There is apparently no important distinction in this respect between the two sexes.

Not only are the children at the youngest ages more susceptible to scarlet fever, but it appears that these children also take the disease in the severest form. This is evidenced by Table 2, which presents lethal rates for the number of deaths per hundred cases treated, classified by age.

There were in all ninety deaths in the total of 1,153 cases; this represents a lethal rate of 7.8 per cent. At age 2, next birthday, 15.5 died out of every hundred

TABLE 2.—LETHAL RATES PER HUNDRED CASES TREATED FOR SCARLET FEVER, CLASSIFIED BY AGE

Age	Number Treated	Number Died Under Treatment	Lethal Rate per 100 Cases Treated
All ages......................	1,153	90	7.81
2 to 10........................	941	83	8.82
2 to 5........................	503	51	10.14
2............................	103	16	15.53
3............................	132	16	12.12
4............................	148	11	7.43
5............................	120	8	6.67
6 to 10........................	438	32	7.31
6............................	123	14	13.38
7............................	114	7	6.14
8............................	76	3	3.95
9............................	65	6	9.23
10............................	60	2	3.33
11 to 15..................	132	4	3.03
16 to 20.......................	43	1	2.33
21 to 30.......................	24	1	4.17
31 to 40.......................	13	1	7.69

treated. For the age period 2 to 5 the lethal rate is 10.1, and for the entire period 2 to 10 the lethal rate is 8.8. Thereafter the lethal rate decreases very appreciably. The very high figure for the age period 31 to 40 is of no significance, since the number of cases was only thirteen and the number of deaths one; altogether too small a group to give reliable returns.

The figures for our series are again in close agreement with those of other observers. The lethal rate of scarlet fever varies considerably with time and place, depending on the severity of the epidemic. An average of 8.4 per cent. is given by McCollom on the basis of over 37,810 cases in Boston, covering a period of

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twenty-eight years. Some hospital figures show a somewhat higher lethal rate. According to Osler, 90 per cent. of all the scarlet fever deaths are of children under 10; our figure was 92 per cent. As our cases were drawn from all parts of the country, no particular epidemic is unduly represented, and the findings are close to the best previously reported averages for large series of cases covering many years.

The 90 deaths showed complications in 62 cases. In 11 of these there was a distinct kidney involvement. Heart conditions were recorded in 7 fatal cases. Pneumonia was present in 13 cases. There were 4 cases of meningitis and 1 case of otitis media. In 9 cases the scarlet fever was complicated by the presence of other acute infections like diphtheria or measles. The other complications are few in number, and are too vaguely stated to justify special attention. Among the 1,063 survivors we find similarly a record of 31 cases of nephritis, 31 cases of otitis media, 22 cases of adenitis, and 11 cases of pneumonia. It is very probable, however, that in the nonfatal cases the complications were not stated as fully as could be wished, certainly not as fully as is usually done in hospital practice. Osler, for example, records the presence of nephritis in from 10 to 20 per cent. of his cases. Heart complications are also recorded in higher proportions in other series. Middle ear trouble is reported in 20 per cent. of all cases by Fisher, and the same author, in a series of over 6,000 cases, records 14 per cent. that had adenitis. We must not infer, however, from the smaller number of complications recorded by us that the cases were less severe than is usual. We have already shown that the lethal rate is very close to the average obtained by other investigators on the basis of large exposures over long periods.

We are now concerned with the tracing of the 1,063 cases in which the patients survived, and we shall see whether, during the following years, the complications or impairments which they suffered really affected their chances of life to any appreciable degree. There were represented, during the entire subsequent period, 3,583 years of life. This means that the 1,063 persons were under observation for an average period of 3.4 years. The expected number of deaths for this group of survivors was then calculated. The mortality rate actually experienced by the company for the corresponding age, sex and color during the years covered by the study was used as a standard. According to

this measure, we had a right to expect 18.6 deaths. As a matter of fact we experienced only 18 deaths. Far from showing a higher mortality, as was the case in the typhoid fever study, we found a death rate almost identical with the expectation based on our general mortality experience. The actual mortality was 97 per cent. of the expected. We may, therefore, say that during the period covered by our observations the mortality of the survivors as a group shows apparently no increase. Table 3 presents a comparison of the actual and expected mortality among the 1,063 survivors, classified by age period.

The most favorable condition is found in the age period 2 to 5 years. The actual number of deaths is somewhat higher than expected in the age period 6 to 10 (117 per cent.). The deaths are considerably higher in the period 11 to 15 (244 per cent.). In view of the small number of persons exposed in this age period the figures must not be considered as entirely decisive, although they are suggestive.

TABLE 3.—COMPARISON OF ACTUAL AND EXPECTED MOR-
TALITY AMONG 1,063 PERSONS IN FIVE YEARS FOL-
LOWING RECOVERY FROM SCARLET FEVER;
CLASSIFIED BY AGE PERIOD

Age Period	Number of Years of Life	Number of Expected Deaths	Number of Actual Deaths	Actual Deaths per 100 Expected
All ages	3,583.46	18.61	18	97
2 to 5	908.29	9.16	7	76
6 to 10	1,614.35	6.00	7	117
11 to 15	699.53	1.64	4	244
16 to 20	194.88	0.62	..	...
21 to 30	105.66	0.67	..	...
31 to 40	60.75	0.52	..	...

It is of interest to find that, of the eighteen deaths which occurred in the four years, three showed a record of endocarditis on the death certificates; these cases may reflect the impairment resulting from the original scarlet fever. There were five deaths from respiratory diseases and four from tuberculosis. The remainder were scattered among a number of causes which have no particular interest for us. Strangely enough, there were no deaths from kidney diseases. Apparently, among the survivors of the primary disease, the kidneys were not sufficiently impaired to cause early death.

We are concerned, therefore, with explaining the difference between the actual experience and that which was expected on the analogy of our typhoid

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fever investigation. A comparison of the two sets of conditions is useful, moreover, because it helps to a clearer insight into the kind of impairment which results from scarlet fever. In the typhoid fever cases there was, after recovery, a marked increase in the number of tuberculosis deaths. An increase was also noted in the number of deaths from organic diseases of the heart, but this was not so great. In our scarlet fever cases, on the other hand, there is no positive evidence of an increase in the number of tuberculosis cases. The three deaths from endocarditis are too few to justify any conclusion as to serious heart impairment in the survivors. The interesting fact is the absence of deaths from kidney diseases. It would seem, then (and this is confirmed by clinicians), either that impairments of the kidneys, which are so common in scarlet fever, are severe enough to cause immediate death, or that in the survivors the injurious effect is not sufficiently great to kill within the next five years. Apparently, in the cases in which there was recovery, there has not been enough destruction of kidney tissue to prevent subsequent regeneration. It is quite possible, of course, that ultimately there may be an increase in the expected number of deaths from kidney lesions, although such a consequence may not manifest itself until ten or more years have elapsed after the initial incidence of the scarlet fever. We hope to clear up this possibility in the future.

DEATH RATES FROM SCARLET FEVER

Although, as I have indicated, the sequelae of scarlet fever are apparently not an appreciable factor in the mortality of survivors, it should not be overlooked that the disease itself still constitutes an important factor in child mortality. The disease has not shown the same amount of decrease in frequency during the last fifteen years that has been observed in connection with other infectious diseases. The death rate fluctuates about the figure 10 per hundred thousand. In 1900 the scarlet fever death rate in the registration area was 10.2; in 1913 the rate was 8.7. In spite of this drop, there were a number of years in the intervening period when the rate was even higher than the 1900 figure. Light is cast on the mortality conditions from this cause by the industrial mortality experience of the Metropolitan Life Insurance Company, the fig-

ures for which are presented in Table 4. These rates are new and have the particular advantage of accuracy. The count is correct not only for the number of deaths from scarlet fever, but also for the number of persons living in the various classes by which the mortality is enumerated. We are able to present rates by age period, sex and color.

The most interesting fact indicated by this table is the markedly lower mortality of the colored. Gen-

TABLE 4.—MORTALITY EXPERIENCE FROM SCARLET FEVER, 1911-1914, 3,778 DEATHS CLASSIFIED BY COLOR, BY SEX AND BY AGE PERIOD; DEATH RATES PER HUNDRED THOUSAND; METROPOLITAN LIFE INSURANCE COMPANY—INDUSTRIAL DEPARTMENT

Age Period	Per-sons	White Males	White Females	Colored Males	Colored Females
All ages	11.1	13.8	11.2	2.7	2.2
Under 5	64.4	71.1	64.7	17.4	21.9
5 to 9	29.5	27.3	31.0	10.3	7.3
10 to 14	8.0	7.2	9.7	5.3	2.4
15 to 19	3.5	3.8	3.7	0.5	2.2
20 to 24	1.8	1.1	2.9	....	0.4
25 to 34	0.9	0.7	1.3	0.3	0.2
35 to 44	0.5	0.6	0.5	....	0.5
45 to 54	0.2	0.2	0.1	0.5	....
55 to 64	0.3	0.2	0.3	....	0.7
65 to 74	....	....	....	....	....
75 and over	0.8	....	1.4	....	....

TABLE 5.—INCIDENCE OF 1,153 SCARLET FEVER CASES, 1911-1912, BY MONTHS

Month of Occurrence	No. of Cases	Month of Occurrence	No. of Cases
January	105	July	53
February	111	August	45
March	133	September	36
April	141	October	71
May	149	November	82
June	119	December	108

erally speaking, the death rate for colored children is about one fourth that of the whites. This fact may serve medical investigators as a point of departure for a study of the etiology of this still obscure disease.
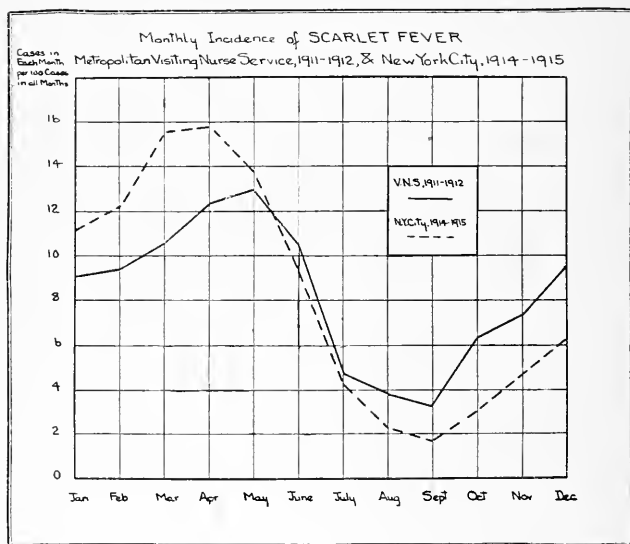
SEASONAL DISTRIBUTION OF SCARLET FEVER CASES

Our study has also made possible a presentation of the seasonal distribution of the 1,153 cases of scarlet fever. This distribution is shown in Table 5.

From January the frequency of the disease rises rapidly until May, when the maximum number of cases occurs. Thereafter there is a rapid drop in the

number until September, which is marked by the minimum. For the remainder of the year there is a rise in the curve, which stops at a slightly higher point than that experienced in the previous January.

The accompanying chart shows the seasonal distribution of these scarlet fever cases compared with the distribution of 20,984 cases reported by the Department of Health of New York City for the two years 1914-1915. The cases which were reported in each month, per thousand occurring in the entire year, are shown.

Seasonal distribution of scarlet fever cases.

The two series are clearly similar in their distribution. The largest number of deaths occurs, in both, during the months of April and May, and the fewest number in September. It is during the summer months that the cases are rarest in their occurrence, and it is quite possible that this condition is correlated with the absence of children from school during the vacation period. With the opening of school in September the number of cases begins to increase rapidly, reaching the maximum in the spring. Of course, attendance at school is not the only factor, since certain respiratory diseases show a similar seasonal distribution, and are clearly subject to the weather conditions.

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